Active Project (2016 - 2016)

High Energy Long Life Betavoltaic Battery, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

The proposed innovation will dramatically improve the performance of tritium-powered betavoltaic batteries through the development of an ultra thin p on n junction composed of indium gallium phosphide coupled to a thin film metal tritide. The thin cell will be built using MicroLink's signature epitaxial lift off technology and standard metalorganic chemical vapor deposition (MOCVD) along with City Labs' tritium betavoltaic expertise. The proposed betavoltaic p/n junction can be stacked in a box or rolled into a cylinder and will provide a cost saving of up to 90%, while increasing energy density to up to twenty times that of lithium batteries. Such an advanced semiconductor device will produce much higher power outputs than are possible with existing state-of-the-art devices as illustrated in the Figure. It will provide the battery a life span in excess of 20 years with the broad-range temperature-insensitivity benefits normally associated with betavoltaics. This increased power/energy density for tritium betavoltaics will open up pathways for significant advances in power solutions for diminutive sized, low-power microelectronic devices that may be used in Cubesat and in-space power systems. Example applications include microwatt-to-milliwatt autonomous 20+ year sensors/microelectronics for use in structural monitoring, mesh networks, tagging and tracking wireless sensors, medical device implants, and deep space power where solar is not easily available. Tritium betavoltaics are capable of addressing this power niche for devices requiring reliable, uninterrupted power through extremes of temperature, longevity and diminutive form factors where traditional batteries cannot operate.

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: MicroLink and City Labs anticipate that the proposed work will result in the creation of a betavoltaic battery with a volumetric power density of 200

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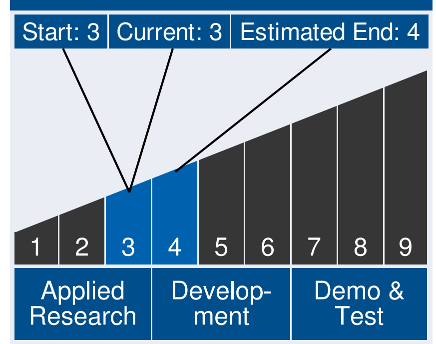
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

Continued on following page.

microwatts/cm3, a lifetime in excess of 20 years, an energy density of 20 times that of lithium batteries (integrated over 20 years of continuous power) and a cost reduction of a factor of 10 (from $1000/microwatt to $100/microwatt). This combination of factors will allow tritium betavoltaics to be introduced to a mainstream market in a number of potential NASA applications, including high value deep space missions, independent power sources for spacecraft electronics and backup communications systems.

To the commercial space industry:

Potential Non-NASA Commercial Applications: Potential non-NASA applications include: battery back-up power for FPGA encryption keys used in many defense and security applications, domestic anti-tamper for defense applications, nuclear storage/ device monitoring for defense applications, satellite power supplies, including cubesats, SRAM (static random access memory) volatile memory, sensors, and medical bionics/ implants. In the government sector, customers include the US Air Force, US Navy, Special Forces, CIA, NSA, and NRO. In the commercial sector, potential customers include commercial satellite manufacturers, such as Lockheed Martin, Boeing, and Space Systems Loral, medical device makers, semiconductor device makers, such as Intel, and AMD, and sensor makers. It should be noted that City Labs has sold prototype and commercial batteries into select high value markets with premium customers such as Lockheed Martin, NASA?s Jet Propulsion Laboratory, and Lawrence Livermore National Laboratory.

Management Team *(cont.)*

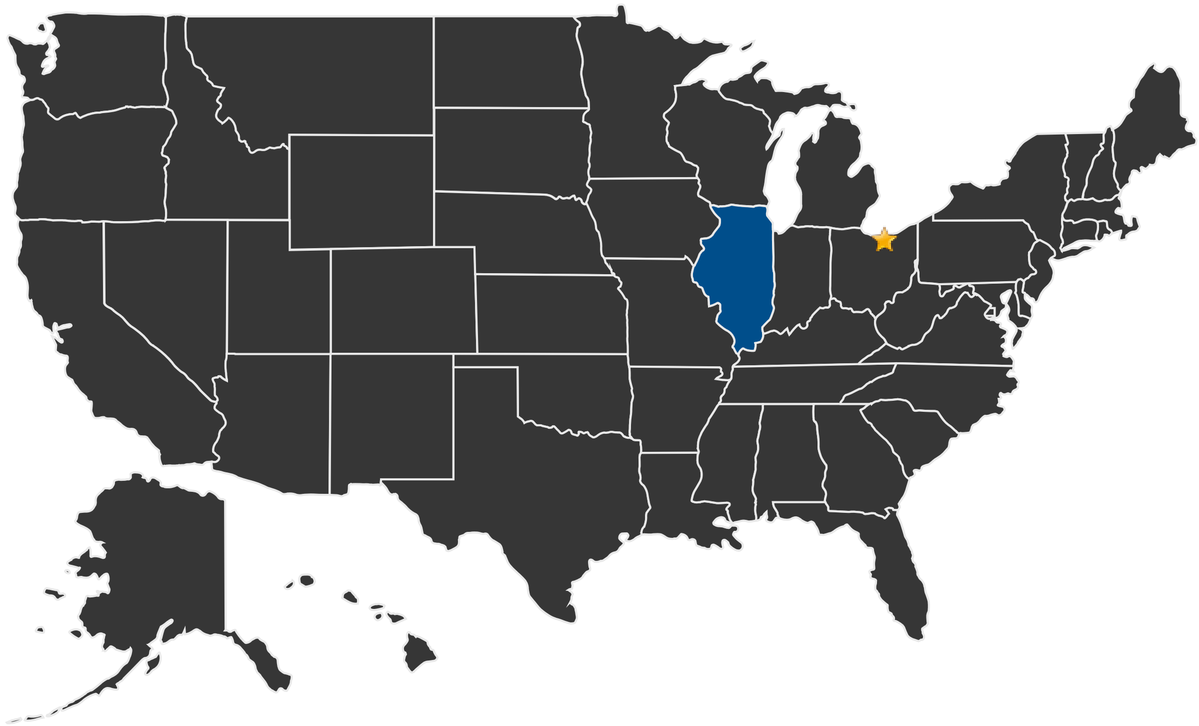
Principal Investigator:

- Glen Hillier

Technology Areas

Primary Technology Area:
Space Power and Energy Storage (TA 3)
└─ Power Generation (TA 3.1)
 └─ Solar (TA 3.1.3)

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Glenn Research Center

Other Organizations Performing Work:

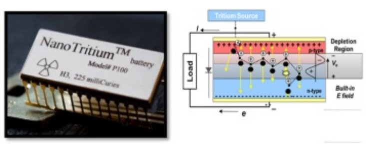
- MicroLink Devices, Inc. (Niles, IL)

PROJECT LIBRARY

Presentations

- Briefing Chart
    - (http://techport.nasa.gov:80/file/23458)

IMAGE GALLERY



High Energy Long Life Betavoltaic Battery, Phase I

DETAILS FOR TECHNOLOGY 1

Technology Title

High Energy Long Life Betavoltaic Battery, Phase I

Potential Applications

MicroLink and City Labs anticipate that the proposed work will result in the creation of a betavoltaic battery with a volumetric power density of 200 microwatts/cm3, a lifetime in excess of 20 years, an energy density of 20 times that of lithium batteries (integrated over 20 years of continuous power) and a cost reduction of a factor of 10 (from $1000/microwatt to $100/microwatt). This combination of factors will allow tritium betavoltaics to be introduced to a mainstream market in a number of potential NASA applications, including high value deep space missions, independent power sources for spacecraft electronics and backup communications systems.